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# Designing for Light-Weight Collaboration: The case of Interactive Citizens' Advisory Services

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**Abstract.** This paper reports on the design of a collaborative system to support citizens' advisory services. Recent research on the adoption of collaborative technologies indicates that: a) successful collaborative technologies diffuse from the private sector to the business sector and not vice versa, b) collaborative processes evolve and therefore cannot be prestructured in detail, and c) creative collaboration can be characterized as creating and sharing mental models. We demonstrate how these insights informed our design of a citizens' advisory system and provide data from an evaluation in a German city. Implications for the design of our collaborative system are offered.

**Keywords:** CSCW, Collaboration Information Technologies, CIT, E-Government, Advisory Support, Citizenship Information.

## 1 Introduction

The history of collaborative technologies is a history of great promises, large failures and surprising successes. Most users have appropriated Lotus Notes only as an advanced mailing and scheduling system, not taking into consideration that it offers a comprehensive collaboration support. Although large productivity effects have reported on the use of Group Support Systems [1], most companies abolish them after an extended initial implementation [2]. On the other hand, "light-weight" collaborative technologies, such as Wikis, Chats and Twitter, have very quickly been adopted in the private sector and from there moved into the corporate IT. It appears that a strategy of bottom up diffusion of "light weight" collaborative tools linked to the users' private lives is a more appropriate strategy than is the classical top-down-diffusion of "heavy-weight" collaboration support [3]. How can we learn from the success of those light-weight collaborative tools? How can their success inform the design of collaboration support that is applicable in an organizational setting? How can designers induce users to appropriate new collaboration practices? These were questions we asked ourselves when we started off designing a tool to establish a new interaction between citizens and their advisors in public administration.

In the subsequent literature section we introduce relevant literature on the adoption of collaborative technologies. Section 3 describes the design, i.e., the design context of citizen advisory, generic requirements, the design methodology and process, and

the resulting prototype. Section 4 presents the results of an evaluation. Section 5 ends the paper with our conclusions and implications.

## 2 Adoption of Collaborative Technologies: Field experiences and Design implications

Ever since collaborative technologies were invented in the middle of the 1980s, there has been dispute as to how they should be designed in order to be adopted in the workplace. A significant stream of research has focused on the organizational context and incentive systems. Orlikowski [4] shows how a Lotus Notes implementation failed because the use of the system was not in the interest of the users. Grudin first showed that groupware adoption (in his case: shared calendars) could fail if critical masses were not achieved [5], although he later admitted that peer pressure (!) could lead to a comprehensive adoption [6]. There have been numerous studies of successful Group Support System pilots [7], but many sites have since been abandoned. Researchers argue that facilitation skills are a major bottleneck, as skilled facilitators are needed but then are quickly promoted to other jobs when they are successful. Recent research therefore focuses on replacing the facilitator with tested collaboration patterns that the end user can apply without training [8]. While we acknowledge that organizational issues can influence design, this paper concentrates on the collaborational aspects that influence design for our chosen setting. Here we identify three relevant streams of research. In the following, we characterize each stream and introduce the underlying theories and concepts.

*1. Successful collaborative technologies diffuse from the private sector to the business sector and not vice versa.* In an extensive literature analysis on case studies of Collaboration Information Technologies (CIT) diffusion, Shumarova [9] concludes that successful CIT diffuse bottom up rather than being imposed top down by a company management. Tapscott and Williams ([10] p. 253) quote John Seely Brown from Xerox Parc on the example of Wikis: "A lot of corporations are using wikis without top management even knowing it. It's a bottom-up phenomenon. The CIO may not get it, but the people actually doing the work see the need for them." Tim Bray from Sun Microsystems is quoted for the following statement "…the technologies that come along and change the world are the simple, unplanned ones that emerge from the grassroots rather than ones that come out of the corner offices of corporate strategists" ([10] p. 253). Shumarova and Swatman [3] observe that successful CIT applications typically are Shadow CIT, i.e., tools that "are not implemented as part of the organisational IT infrastructure, neither have they received any targeted organisational investment"([3] p.371). These tools are first adopted into the private social life and then are gradually transferred into the business sector (e.g., via professional activities outside the company). Why is this the case? One argument stresses the primacy of the social function of collaboration. McGrath [11] already stressed in 1991 that team work not only has a productivity function, but also it should also support its members and the group well-being. Yet, it may make more sense to view social worlds as units of analysis, because team boundaries fluctuate

and reconfigure [12]. If the social function is very important or dominates CIT adoption, it is much easier and more attractive to explore and adopt new technologies in the unregulated private network than in regulated and more rigid business hierarchies. Another argument looks at the nature of the tools: business oriented CIT tend to pre-structure collaborative work, while socially oriented CIT provide only simple structures and allow other structures to emerge. This argument will be discussed in the subsequent section.

*2. Collaborative processes evolve and therefore cannot be prestructured in detail.* CIT originating from the business sector tend to mimic business organizations, more specifically by: a) implementing the organizational hierarchy and role models into the software (most visible in Lotus Notes) and b) implementing the plan-act-control cycle of management. Any collaboration activity is first planned e.g., by setting up the "appropriate" structures (e.g., setting up a team room in Lotus Notes or an agenda in Group Systems), and then these structures are used by the collaborators and result in a trace of data that can be controlled (e.g., a project documents, electronic meeting minutes). The underlying assumption of this engineering approach to collaboration is that collaborative activities can be pre-planned and thus prestructured. In a famous discussion with Terry Winograd, Suchmann [13] argues that content develops during communication, and thus communicators cannot make their intentions explicit before they voice an opinion. The German poet, Heinrich von Kleist [14], talked beautifully in 1805 about the "gradual composition of thought while speaking."[1] Thus, E-Mail-systems that pre-structure communication based on speech acts, in this case the co-ordinator [15] are doomed to fail. A study on the adoption of CITs indicates that this finding can be generalized to other kinds of CITs. In 2005, Bajwa et al [16]) showed that only E-Mail had reached high utilization levels - the other (formal) CITs had not been adopted in the workplace. On the other hand, online communities, Skype, Blogs, Social networks (e.g., Facebook), and to some extent Wikis, have been adopted diffused in the private sector first and then been introduced into companies. The nature of collaborative work often requires 'technological improvisation' [17] dealing with exceptions, unexpected breakdowns and emerging opportunities. This is particularly the case in creative, design oriented work. "Design […] is more emergent, more continuous, more filled with surprise, more difficult to control, more tied to the content of action, and more affected by what people pay attention to" ([18], p. 61).

*3. Creative collaboration can be characterized as creating and sharing mental models.* Social collaboration is mostly based on communication - and it is no surprise that, given the widespread adoption of mobile phones, E-Mail, instant messaging, and online forums show, communication support has most easily been adopted for private and work life. However, creative collaboration is rarely based on communication only. As Shrage [19] and Schwabe [20] elaborate, it relies on a shared artifact. These artifacts externalize mental models and allow them to be jointly viewed and manipulated. The artifacts need to be flexible in order to represent both the problem space as well as the emerging solutions. Such an effective sharing of information can then enhance group productivity [21].

[1] Translation by the author

## 3 Design: Process and Result

### 3.1 The Design context: Citizens' Advisory

While commercial service industries (e.g., banks [22], [23]) have made significant advances in improving their advisory services, the public sector is lagging behind: there is a significant gap between support offered that consists of simple telephone services and self service information on the Internet, and the information needs of a citizen in complex life circumstances. Pure information is not sufficient if citizens are not able to express their information needs [24]. For example, a pregnant woman may very well describe her situation (i.e. being pregnant), but may not know what specific information to look for (i.e. what support and services could be applicable for her situation). Structuring websites according to life's circumstances may give a good general starting point, but this does not offer sufficient personalized support. Good advice can be found in the public administration offices (local, regional, state and federal), but it tends to be fragmented and distributed among different agencies [25]. Citizens lack orientation about what to ask, whom to address and how to use the information provided. In a prior publication, we have provided evidence of the need for an advisory service in German public administration concerning the circumstances of a pregnant woman [26]. In mystery shoppings in 18 German cities, good advice for pregnant women was found to be rare, and a systematic and integrated search for solutions was lacking in all communities. A good advisory process has (at least) two phases: The information need is determined first, after which the necessary information is aggregated and activities are initiated [27]. In the description of the prototype, we delve into greater detail of the advisory process.

### 3.2 Generic requirements

In this section, generic requirements for Citizens' Advisory Systems (CAS) from the themes identified in section 2 are derived. Theme one urges to implement CIT bottom up and moving it from a private sector to the business sector. This is not completely possible with an application that has no use in the private sector, but building blocks from the private can be used to a large extent. This leads to the following generic requirements for the CAS:

R1. *Include Web 2.0 and community based information*. This means established basic information systems such as google maps that can be used build collaborative applications on top of it ("mash ups"). But this also includes community based information, e.g., discussion forums for pregnant women or rating sites for birth related services. These offer an additional perspective that a public administration is not willing or not able to provide itself. For some topics, citizens trust other citizens more than a public authority. Communities can be used in order to search for information during the advisory process or to follow up on issues left open during the session.

Theme one furthermore stressed the primacy of the social function over the productivity function of collaboration. Therefore we propose the following two requirements:

R2. *Allow the user to establish a personal relationship during, and develop it after, the interaction*. In a face-to-face interaction, the advisor can establish a personal relationship by a pleasing presentation of herself and a professional communication. In a distributed setup (not discussed further in this paper), providing pictures and some basic information of the advisor will increase the trust of the citizen [28]. A good citizens' advisor develops a personal relationship not only between the citizen and herself, but also with other relevant persons, e.g., peers in a community or other public officers.

R3. *Base the interaction on verbal communication*. Public authorities tend to rely on forms for gathering information. As we argue in [26], forms are of little use as long as the problem is ill-defined and open ended. The advisor can use her background knowledge and empathy with the citizen to uncover hidden information needs and offer advice not explicitly requested [24]. This is particularly valuable in novel life circumstances. A verbal discussion on problems and possible solutions is also a more natural means of collaboration.

Theme 2 suggests that collaborative processes evolve. This leads to the following generic requirements for the CAS.

R4. *Keep work processes simple*. While there is evidence that elaborate advisory processes can be useful (they are recommended in other sectors such as in banks), lack of acceptance of these models in the workplace [29] supports the argument that an elaborate predefined process may be an obstacle rather than a scaffold, if the subject matter is sufficiently complex.

R5. *Support the evolution of process structure during collaboration*. A lack of prescribed structure does not rule out the ongoing structuring of the work by the participants. Rather, some structure is necessary to support mutual understanding of the current status achieved and the upcoming activities at hand. Thus, there should be features for the users to create and develop their structures during their ongoing collaboration

R6. *The state of collaboration must be transparent at all times*. Advisory issues can be complex. Since there is no standardized process enforced to scaffold the collaboration, the users must be able to understand the state of their collaboration at any time, e.g., which results have been achieved, how they were achieved, which issues still remain open, and how these open issues can be addressed.

Theme 3 argues that creative problem solving activities should be based on externalized mental models. This leads to the following generic requirements for the CAS.

R7. *Support the externalization of mental models*. Externalization of mental models requires a modeling space and modeling language understood by both advisors and a wide range of citizens. Thus, they have to be simple and be based on common-known metaphors. These externalized models should support joint reasoning about the problem and potential solutions. They should serve as boundary objects [30] between the citizens' and the administration.

R8. *Support the flexible sharing of artifacts capturing mental models*. The artifacts must at least be visible for both users; preferably both advisor and citizens are able to work with the artifacts. For the face-to-face setting, the literature on single display collaboration [31] provides more detailed design guidelines.

### 3.3 Design and implementation methodology and process

The generic requirements were instantiated in the system: Citizens Advisory 2.0. They were implemented in a diploma thesis from March to September 2009 [32]. Scenario based design [33] was selected for development, and as an application scenario, the life situation "birth" was chosen. In scenario based design, the scenarios are the focal artifact for developing a shared understanding of developers and users. Scenarios are informal, situated descriptions of usage in natural language. They allow a holistic perspective on the IT usage. In our case, during the requirements analysis, problem scenarios were used to document the initial situation and their problems. In the subsequent design phase, activity scenarios, information scenarios and interaction scenarios were used to describe the solution. On the basis of the developed understanding, a prototype was developed using the Microsoft .net framework, Silverlight and a HP Touchsmart PC.

Empirical data was captured as part of the requirements analysis via mystery shoppings and workshops with citizens and advisors (for details [27]). The prototype was evaluated with 15 pregnant women (or women who had just given birth) and 7 advisors from the city of Sindelfingen in Southern Germany. This number of evaluators is typical for first prototype evaluations in leading design oriented computer science conferences (CHI, CSCW), but the results cannot yet be generalized to different organizational settings. Each test session lasted 20-30 minutes. Data was captured using screen capture software, observations and questionnaires for advisors and citizens. The core of the questionnaire was based on the UTAUT Framework [34]. Specific questions regarding usability and the generic requirements were added. Details on the development process and the questionnaire can be found in [32].


Fig. 1: Information Spaces

### 3.4 Prototype implementation of the generic requirements

The system consists of five information spaces (figure 1): In the topic space, the advisor and the citizens establish the problems that

need to be addressed, e.g., housing, finding childcare or applying for public support. Under each topic, the locations, activities, dates and resources of solutions can be explored. For example, a pregnant woman searching for childcare can find the location of kindergartens (locations on a map), apply for admission (activities with forms), note when she has to become active (dates on a calendar), and find additional information in the resources information space using web links.

Figure 2 shows the central topics space.

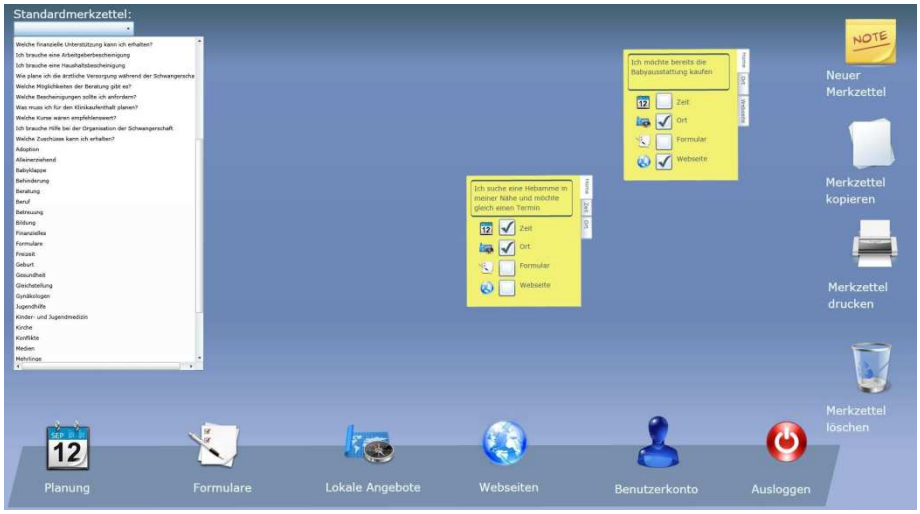


Figure 2: Topics Space

Two memo cards have been created in the discussion between advisor and citizen for two topics (they can be created from scratch or selected from a list of predefined topics on the right side). After defining topics in writing, the pregnant woman and advisor search for solutions by exploring the other spaces. While doing so, they take the memo cards along to the next information space and link all results to it. For this purpose, four link fields are predefined on each card (one for each supporting information space).

Figure 3 shows the locations space as an example of the other spaces. The advisor and citizen can explore a map to find a locality where the solution is placed (e.g., a suitable Kindergarten). The current memo card can be seen on the left side of the screen. At any time, the users can switch to any other information space (= new screen).

Citizens and advisors first define a list of topics and then work through them in any order they wish. For each topic, they aggregate all information (including filling out application forms) needed. As the application is presented to them on a large desktop touch screen monitor, both can view and interact with the application. When they are finished the information is handed over to the citizen as a print out or in electronic form.

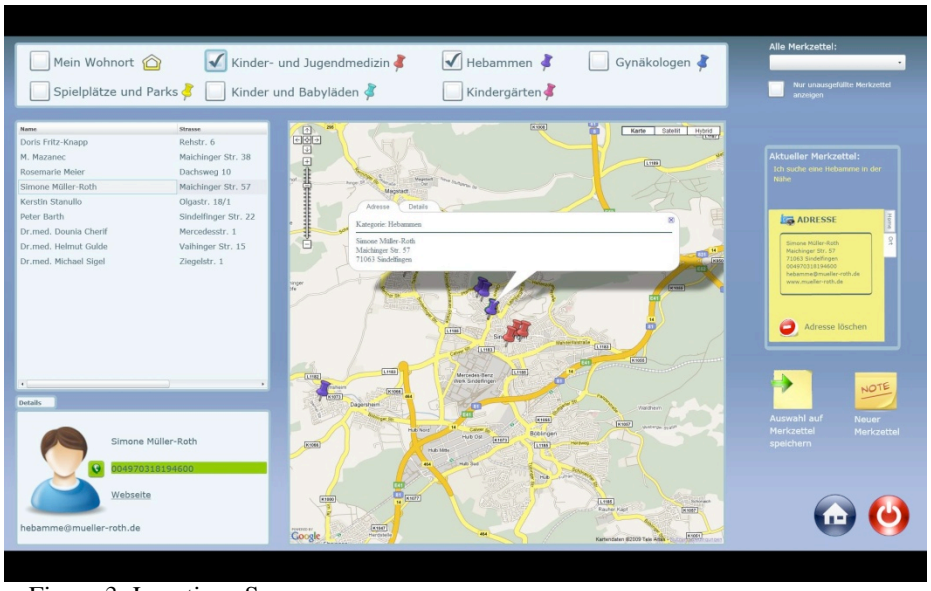

Figure 3: Locations Space

As we will see in the evaluation, this approach is sufficient to fulfill a pregnant woman's information needs and to enable her to become active. Key to success is the insight that public advisory is an activity of information aggregation. This leads to the five information spaces as basic architecture. Although it may be advisable that the advisor and the citizen first get an overview of the problems using the topic space and then find solutions for each of the topics, there is no prescribed order in which spaces have to be visited and when. In the test sessions we observed very different work processes, ranging from a very systematic problem solving process to improvized free-wheeling between the information spaces. Thus the work process is simple (R4) and does not *prescribe* a work process (R5).Rather, the topic space allows the users to structure their work processes themselves as they progress with their work: We have observed users sorting memo cards to piles (prioritizing or sorting them) and then transferring them to other piles once a topic has been finished.

The other key to a successful application is the card metaphor, which is simple enough so that all observed users can externalize their mental models in a desktop layout of memo cards (R7). In combination with well-known web applications, problem solving activities are not hindered by difficulties in understanding the modeling concepts, but they are sufficiently rich to represent the problems at hand. The memo cards are visible in all information spaces and thus establish a context for each activity. Each makes the progress in the information spaces visible (by marking the link to it) and - together with the arrangement of the memo cards on the topic space –they make the work status transparent any time (R6).

The Citizens Advisor 2.0 is meant to be used in a face-to-face setting based on oral communication (R3). While we accept that some asynchronous online advisory may be possible, the face-to-face set-up combines the strengths of human advisory and web-based information in a way that cannot be automated in the foreseeable future.

The shared view makes all activities transparent to both advisors and citizens, and the created artifacts can be touched on the screen (R8). The rich face-to-face set-up allows the citizens to establish a personal relationship for discussing critical personal issues (R2). This personal relationship can be extended to other persons as the citizens are made acquainted with relevant user communities in the resource space (R1).

While we are not aware of any advisory system built in a similar manner, our system does build on ideas, concepts and systems discussed in the literature. The basic interaction metaphors (especially interaction aspects not discussed in this paper) benefit from the literature on single display groupware [31].The structuring of collaboration into different information spaces has been discussed by [35]; however, its application to the information aggregation task of an advisor is novel.

Physical memo cards have been used in moderation for gathering and structuring topics for several decades. The cognoter (one of the first CSCW tool created, [36]) transferred the idea to the computer, and Apple popularized the concept of using hyper cards for structuring, linking and storing information. The room metaphor [37] proposed using card-like containers to move information from one information space to another. However, these publications discuss basic technology, and the envisioned user scenarios are different from the face-to-face advisory. Thus, our approach cannot be found in the basic technological building blocks, but it is novel in its purposeful assembly for providing a coherent, theoretically reflected solution on a medium level of abstraction (as typical for design oriented IS research).

## 4 Evaluation

This section presents a selection of the extensive evaluation results. Due to space limitations, we focus on those results most closely related to the requirements. All the evaluation results are available in German in [32]; selected further evaluation results can be found in [27]. The evaluation results indicate that the eight generic requirements have been successfully implemented in the prototype. The following sections present the results from 15 citizens and 7 advisors as a tuple (<citizens' average>/<advisors' average>). If a statement was only presented to one user group, only one number is given. The subjects were presented with a statement and had to indicate their agreement on a scale from 1= "I totally disagree" to "7 = I totally agree." The overall evaluation was very positive: The users clearly agreed with the statements: "I felt, the tested advisory session was productive" (6.2/5.9), "The tested advisory session was an interesting advisory experience" (6.2/6.0) and "I have generally liked the advisory session" (6.3/6.3).The citizens report that they "would use the advisory session as a service" (6.9), and the advisors "regard the system as useful for their work" (6.9). After the session, one pregnant woman asked, "When will the service be available?" and another woman stated, "We have had our children too early - we should have waited!" Thus, the Citizens Advisor 2.0 achieved user acceptance as far as it is possible with a prototype system. What contributed to this success?

The users widely agreed that the resources information space "with web pages on the topic birth ... is convenient to find websites" (6.3/6.1) and "is sufficient to achieve what is desired" (6.2/6.0). Thus, the *community based information* (R1) was

implemented in a satisfactory manner. The citizens widely agreed that "the advisory appeared trustworthy" (6.4). Thus, the CAS allowed *the user to establish a personal relationship* (R2), indicating that the *verbal communication* during the advisory session was successful (R3). Although advisors had only half an hour training or no training at all, before the test sessions, the majority of the citizens agreed with the statement, "I could do my tasks with the system even if nobody were available to explain to me what to do" (5.5).This is a surprising result for a system which is meant to be facilitated by an advisor! The advisors agreed even slightly more with the statement above (5.7), and unanimously agreed that "it would be easy for me to become competent in the usage of system" (6.9). This indicates that the *work processes are fairly simple* (R4).

The work processes were primarily structured by the memo cards. Generally, the users overwhelmingly agreed that the "the idea of memo cards is good" (6.5/6.6). The users agreed that "the memo cards enable easy switching between screens" (6.1/5.7), indicating (together with the general high evaluation of memo cards) that there is acceptance of the chosen approach to *support the evolution of process structure during collaboration* (R5). The widespread agreement with the following statement indicates that it provides suitable support for the *externalization of mental models* (R7): "In the tested advisory session, my thoughts and concerns are well made manifest by the memo cards" (6.3/6.4). There is also ample positive user feedback on the *transparency of the state of collaboration* (R6): "The approach to store selections on the memo card ... is useful" (6.4/6.3), "... easy to use" (6.4/5.7)"...is clearly represented" (6.4/6.3) and ".... allows to interrupt work any time and to continue work any time without loss"(6.4/6.4). Further, the users agreed with the overall statement that the "system usage is clear and comprehensible" (6.1/6.3). Several evaluations also indicate that the system sufficiently supports *the flexible sharing of artifacts capturing mental models* (R8). "The joint usage of the screen enabled a productive advisory session" (6.3/6.6). Thus, the citizens "had many possibilities to contribute actively" (6.0/6.4).

## 5 Conclusions

The overall positive user feedback indicates that the prototype development was successful. We regard our most important success that the CAS was approved not only by the advisory clients, but also by the advisors themselves. Advisors tend to be very cautious in accepting technology for the advisory session itself because the application may not be in their interest (e.g., they may be afraid of being controlled) and because they fear losing face in the eyes of the client if they fail to cope with the software [29]. Feedback from representatives of the public administration indicates that the approach demonstrated may be applicable to a wide area of advisory tasks in the public administration.

As the software has not been rolled out to cities, it is premature to draw conclusions on its potential diffusion in the market place. The literature on the diffusion of collaborative technologies suggests that adoptable CIT should be simple,

less pre-structured, support the evolution of structures, and be more social. Some of this CIT can be directly diffused from the private sector to the business sector. However, there are many specialized application areas for collaboration that require more specific tools. One such area is advisory software. In these areas, many of the attributes of successful "private-sector" CIT need to be integrated (or "meshed up") with the domain specific features of the application. This can mean that successful applications are integrated into the system (as exemplified by the integration of Google maps for the location search or the integration of communities). It may also mean that the principles of successful CIT need to be transferred. In our case, these principles are the simplicity of the work process and also the lack of prescribed process structure. These principles can then be used to revisit the rich archive of generic CIT tools and to make them more usable by reducing their feature set and prescribed structure to the absolute minimum.

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